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A

LETTER

TO

ERASMUS DARWIN, M. D.

ON

A NEW METHOD

OF TREATING

PULMONARY CONSUMPTION,

AND

Some other Diſeaſes hitherto found Incurable.

By THOMAS BEDDOES, M. D.

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A
LETTER *to* DR. DARWIN.

DEAR SIR,

NOTHING but compleat ſucceſs in the treatment of Conſumption could afford me greater ſatisfaction than to find that my theory of this deſtructive diſeaſe appears by no means deſtitute of plauſibility to a Phyſician of your experience and ingenuity.

You aſk whether I have any new facts to add to the probabilities which I have collected in my MEDICAL OBSERVATIONS: (*a*) and you expreſs

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(*a*) See *Obſervations on the Nature and Cure of Calculus, Sea Scurvy, Conſumption, &c.* 8vo. Murray, London. 1793. page 113—148.

expreſs a wiſh for information concerning the apparatus which I have juſt cauſed to be conſtructed for the purpoſe of reducing my theory to practice. I ſhall endeavour fully to ſatisfy your polite enquiries. Liable as they muſt be to miſconception and miſtatement, I am indeed very deſirous to make my real views generally known. For although it is evident that none but beneficial conſequences can reſult to the public from the proſecution of my deſign, yet it requires very little knowledge of the world to perceive the danger to which I am expoſing my reputation. It is impoſſible to engage in a new and arduous undertaking without incurring ridicule and obloquy: Of courſe I muſt expect to be decried by ſome as a ſilly projector, and by others as a rapacious empiric. Secrecy, as you well know, and promiſes unreſtrained by ſenſe or ſhame, conſtitute the *essential character* of empiriciſm: Now I truſt that the Book, to which I have juſt referred, will bear ample teſtimony that on medical ſubjects I have no diſpoſition to ſecrecy. The moſt inattentive reader muſt perceive that I have poured forth my ideas freely and without reſerve; and I know not any thing I have ſo much to dread from the judicious critic, as cenſure for not taking more time to reconſider and arrange them more advantageouſly.

As to the new method, in which I propoſe to treat Conſumption, as well as ſome other mortal diſorders, I cannot but be aware that it would be equally impolitic and diſingenuous to ſpeak of it with greater confidence than it deſerves. Its real efficacy muſt in a ſhort time be aſcertained either by myſelf or by others. I ſhould not therefore fail finally to be a loſer by injudicious boaſting. And I flatter myſelf that I am above all temptations deſignedly to inſpire falſe hopes, and ſo to add diſappointment to the ſufferings of the ſick. Thus every conſideration, you ſee, induces me to keep my expreſſions rather below the tenor of my expectations: And if I ſtrictly obſerve this law, ſurely no perſon of candour will reflect upon me for employing the beſt means that can, I think, till the progreſs of Science ſhall have furniſhed ſome new hints, be imagined for attaining one of the moſt deſirable of all purpoſes---even though I ſhould not at laſt be more ſucceſsful than others have been before me. And with this reflection, I ſhall for the preſent conclude my apology for aſpiring to be uſeful.

The old Medical Writers, and indeed modern writers on the continent, divide Conſumption into a great multitude of ſpecies or varieties. It is no wonder that we, who are certainly their ſuperiors in the logic of Medicine, ſhould reject diſtinctions founded upon ſtates of the body merely imaginary, or ſuch as are not characterized by ſigns obvious to the ſenſes. I am nevertheleſs diſpoſed to think that there exiſts a more eſſential difference between different caſes of Phthiſis Pulmonalis, than the Britiſh practitioners in general ſeem willing to admit. This difference appears to be clearly indicated by the ſymptons; and it would probably be completely aſcertained by diſſection, if it were more the cuſtom to open the bodies of perſons who die conſumptive. Two varieties or two ſpecies have lately appeared to me well marked; they have indeed been noticed by ſeveral of the beſt obſervers in our own and foreign countries; and it is not unlikely that they may require a very different method of treatment during their firſt ſtage.

To the firſt, which may perhaps be termed *the Florid Consumption*, the reaſoning in my book of Obſervations, is excluſively applicable. It is in this ſpecies, eſpecially during its approach and towards its commencement, that we perceive at the time of the acceſſions of feveriſhneſs, the vivid redneſs of the cheeks, as well as an extraordinary permanent redneſs of the lips, of the tongue and fauces. Indeed theſe parts, ſince I have been at pains to examine them very attentively, have uniformly ſuggeſted to me the idea of meat reddened by ſaltpetre. The eyes, too, in ſuch caſes are remarkable for their vivacity. The blood, diſcharged by Epiſtaxis or Hæmoptyſis, has a colour evidently more florid than uſual. In the latter indeed, which in healthy perſons is a rare occurrence, we have not many opportunities of remarking this difference in the colour of the blood, but in the ſpontaneous bleedings of the noſe that ſo frequently take place both in incipient and confirmed Phthiſis, we ſee the blood much brighter than when it flows from healthy perſons, in conſequence of accidental violence.

It is not my intention to repeat either what I have myſelf written concerning the hyperoxygenated ſtate of the ſyſtem in Conſumption, or to tranſcribe from elementary books, a detail of the ordinary progreſs of the ſymptoms. But you will think it not improbable, from the attention I have been lately paying to this diſorder, and the opinion I entertain concerning its nature, that I ſhould be led to remark ſome appearances not commonly known or attended to. Theſe I ſhall from time to time ſubmit to the conſideration of Medical Philoſophers, as ſupplementary to the knowledge accumulated by former experience. In juſtice however to myſelf, as well as to my readers, I muſt remark, that I do not at preſent bring forward any of the following obſervations as *laws* to which the ſyſtem, while affected by florid Conſumption, is invariably ſubject. I have not yet had opportunities enough to enable me to determine whether they *generally* take place, or only accidentally occurred in ſome patients whom I have ſeen ſince the formation of my theory.

1. It is an evident conſequence of my leading opinion, that a phthiſical patient would take a longer time than another perſon in being drowned, or in being ſuffocated in moſt of thoſe airs that are unfit for reſpiration. I ſay *moſt*, becauſe I ſuſpect that nitrous air

might furniſh an exception. Being already provided, as I ſuppoſe them to be, with a larger proportion of that principle which reſpiration introduces into the body, they muſt be able to continue for a longer time without the neceſſity of a new ſupply. And as the left cavities of the heart ſeem to be more irritable in ſuch patients, it is probable that they would be more eaſily recoverable from accidents of this kind, than perſons in an ordinary ſtate of health. This conſequence of my theory is much countenanced by the ſubjoined caſe of the ſon of our common acquaintance, Mr. Crump, ſurgeon and apothecary at Albrighton, in Shropſhire. You will find that he not only breathed with eaſe air of a very low ſtandard, but that he even much preferred it to atmoſpheric air. But I do not pretend to ſay that this fact deciſively proves the greater independance of conſumptive perſons on the function of reſpiration. The air he inſpired was partly hydrogene air. And it ſeems pretty well aſcertained that aſphyxia is leſs ſuddenly produced by hydrogene, than by any other ſpecies of air, unfit for reſpiration.

I lay rather more ſtreſs upon the following, which is the converſe of this obſervation, I imagine that in conſtitutions injured by exceſs of ſpirituous liquors, and more particularly while they are under the primary operation of ſuch liquors, there exiſts a deficiency of oxygene; at leaſt of oxygene in a ſtate of combination ſo looſe as it is found in the circulating blood and moving fibres. A variety of conſiderations with which I will not detain you at this moment, ſeem to me to confirm this opinion. You recollect, among others the caſe of the inflammable woman of Coventry, as deſcribed by Mr. Wilmer. This woman ſeems to have reduced herſelf by dram-drinking to ſuch a ſtate as to be capable of being ſet on fire by a ſpark, and of burning like very combuſtible matter. And one is juſtified by all the known facts relative to combuſtion, in ſuppoſing, that where the ſubſtance of the body was ſo eager to combine with external oxygene, there muſt have been an internal deficiency of this element. I premiſe this conjecture for the ſake of relating that I once ſaw a ſot, while under the influence of liquor, though not nearly intoxicated, reduced in a very ſhort time to a ſtate of inſenſibility by breathing air of an higher ſtandard than that which Mr. G. Crump uſed to breath with pleaſure for an indefinite and certainly a much longer time. I have twice in my life ſeen a perſon habituated to drinking much affected, and indeed on the verge of aſphyxia, by breathing for a few ſeconds a mixture in which the atmoſpheric could not have been to the mephitic air in a proportion leſs than that of five or ſix to one. I need not apologize to you for the want of preciſion in theſe obſervations. No perſon can or ought for a moment to think of aſcertaining ſuch points preciſely by experiments upon Man. I hope, however, ſoon to be able to determine by experiments upon animals, whether the faculty of living in air of a reduced ſtandard is really impaired by the influence of ſpirituous ſtimulants; and when you conſider how nearly all animals of warm blood reſemble each other in this function, you will not, I dare ſay, heſitate to transfer the reſult to the human ſpecies.

Before I paſs on to another obſervation, I will ſtop to aſk you if you do not think it probable that Divers would be able to continue much longer under water, if before immerſion they were for ſome time to breathe air of a much higher than the ordinary ſtandard, or pure oxygene air itſelf.

2. The French writers inform us that Conſumption is leſs common in the ſouthern than in the northern diſtricts of France. From all that I have been able to collect by perſonal enquiry and by reading, I infer that in the the North of France compared with England

this diſeaſe is more rare than would ſeem to follow either from the difference of climate, or any cauſe I have hitherto heard aſſigned. In conformity with my principles, and indeed with what I have expreſsly ſtated (*Observations page* 141), I have lately been led to conjecture that this difference may partly depend on the difference between the ordinary diet of the French and Engliſh people. As far as the articles of food are the ſame in both countries, the French mode of cookery tends to diveſt them of oxygene, or to combine the oxygene more intimately with the other conſtituent parts. The fermentation of their bread is carried much further; hence muſt not a larger quantity of oxygene be carried off from the dough in the carbonic acid air?---Every body knows how much more the French dreſs their meat and vegetables than we do, and how much more oil they add both to the one and the other; all circumſtances which render the food leſs apt to carry oxygene into the ſyſtem.

If I ſhould add that the greater ſummer heats even of the North of France may poſſibly contribute ſomething to the greater freedom of the inhabitants from Conſumption, you will perhaps think that I carry my principles to an extravagant length---and yet may not the effect of the temperature be to occaſion the oxygene to enter, not only more rapidly but in larger proportion, into the ſaline combinations, formed in animal bodies, particularly the perſpirable matter? And does not this hypotheſis afford a better ſolution than has hitherto been given of the different effects of animal and vegetable diet in very hot countries? It ſeems to me well eſtabliſhed that the latter in ſuch countries is much more wholeſome than the former; and as the natives---thoſe of Egypt for example---do not think themſelves in health unleſs they are perſpiring profuſely, may not more oxygene be wanting for the various purpoſes of the animal œconomy than reſpiration can ſupply? eſpecially as the atmoſphere both from its higher temperature and the greater quantity of water it holds diſſolved, probably contains in an equal bulk rather leſs oxygene than in more temperate regions.

3. In the florid Conſumption, I think I have lately remarked, before the period of extreme debility and emaciation, a much greater acuteneſs of the ſenſes than is uſual in health. Soon after I became acquainted with the effect of placing upon the tongue a bit of lead in contact with a bit of ſilver, or of placing one under and one above the tongue and then connecting them by a conductor of electricity, I deſired each perſon in a pretty large company to repeat the experiment upon himſelf. To ſome the ſubacid taſte was not ſenſible, others could perceive it diſtinctly; one perſon preſent was in a confirmed Conſumption; and ſcarce had he applied the two metals to his tongue, than he put them out of his mouth with ſigns of diſguſt, declaring the acid taſte to be ſo diſagreeably ſtrong as nearly to

ſet his teeth an edge.---This opinion as far as it relates to the ſenſes of ſmell and hearing, has been confirmed to me by perſons who have accurately obſerved others ſuffering under the ſame complaint. But at the ſame time it ſhould be recollected that the hearing becomes quicker in ſeveral diſorders; and we know that in different ſtates of the body equal impreſſions on the ſenſe of ſmell will produce very unequal effects upon the ſenſorium. Perhaps this is alſo true of impreſſions of taſte. I muſt therefore leave it to you and other attentive obſervers of animal nature, to determine whether the opinion is in any degree juſt (*b*), and by what limitations it is to be reſtricted.

4. In the indiſpoſition preparatory to Conſumption, I am inclined to ſuppoſe that a remarkable ſymptom occurs rather more fre-

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(*b*) Cullen has an obſervation of an import ſomewhat ſimilar. Hæmoptyſis "happens to perſons of a delicate ſlender make; to perſons of *much ſenſibility and irritability, and therefore of quick parts.*" FIRST LINES II. 340.

quently than is commonly underſtood. This ſymptom is a convulſive cough, often of ſuch alarming violence, as to be likely to perplex and diſconcert inexperienced practitioners. It ſeems to alternate and intermix with the well-known ſhort, dry cough. You will recollect that I had once occaſion to deſcribe to you this convulſive cough from nature. I find it occaſionally mentioned, but not much inſiſted upon, by authors. Thus Dr. Murray, lately Profeſſor at Gottingen, and author of the *Apparatus Medicaminum*, in deſcribing the firſt ſymptoms he obſerved in his brother who died of Conſumption, informs us: *Tuſſis* VEHEMENTER *ingraveſcebat, quæ non catarrhalis unice videbatur, sed simul* ſpaſtica.---*Tuſſis antea sicca, humida fiebat.* (*Murray de phthsi pituitosa apud Baldingerum in sylloge Opusculorum*: *V.* 316.) Raulin (De la Phthiſie pulm: Paris 1782. p. 44) mentions a perſon *qui fut pris au mois d'Aôut* 1771 *d'une toux seche, qui devint plus forte & plus frequente*: *au mois d'Avril*, 1772, *elle etoit* convulſive *sans crachats; elle augmenta au mois de Mai: il survint quelques crachats un peu sanguinolens; & des friſſonnemens au dos, &c. &c.* I ſuppoſe this kind of cough muſt occur in but a ſmall proportion of caſes; otherwiſe it would be more diſtinctly deſcribed, and be the ſubject of more ſpeculation in books than we find to be. From my own obſervations I ſuſpect this cough to be produced by the ſame irritating cauſe (as tubercles, for inſtance) which produces the ſhort, dry cough or whatever other cough may happen in any given caſe to be the forerunner of Conſumption. Upon the moſt attentive examination I could diſcover no other cauſe of irritation. And can you not allow yourſelf to conceive that ſome, and that perhaps a ſmall alteration in the power of the cauſe or in the habit of the patient, may produce ſuch changes in the action of the muſcles, or of the ſtimulus that excites them to act?

5. It is an opinion entertained by many perſons converſant in the hiſtory of medicine, that certain diſeaſes are now much more prevalent, and certain others much leſs ſo, than formerly: Some indeed, that made great havoc in this iſland centuries ago, have now totally or nearly diſappeared. Theſe variations have been imputed, and with great appearance of probability, to the entire change that has taken place during the lapſe of ages in almoſt every circumſtance of the manner of living. But in many inſtances we are not able to fix upon the particular alteration to which the introduction or the extirpation of any given diſeaſe is to be aſcribed; and ſtill leſs can we preciſely determine the effect of the alteration upon the functions of the living body. If it be true, however, as ſo many medical practitioners believe, that Conſumption is now much more frequent (*c*), it is eaſy according to my ſyſtem, to underſtand whence this has happened. The inhabitants

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(*c*) I know ſome old practitioners who are perſuaded that Conſumptions have become more frequent within their own memory.

inhabitants of this country, almoſt without exception, breathe a freer and a purer air than their anceſtors. Nor do I believe that there is any particular in which the difference between the preſent and ſome paſt generations, is ſo remarkable. You ſee then that the ſubjects of our Edwards, and our Henrys, and of good Queen Beſs may have found, in being more free from ſo formidable a diſeaſe than their delicate and airy poſterity, ſome compenſation for the confined air and filth in which they paſſed their exiſtence.

6. I have mentioned *(Obſervations, p. 146)* a caſe of phthiſis where the ribs on one ſide were preſſed quite inwards, and a cavity formed on that ſide, in conſequence no doubt of the deſtruction of the correſponding lobe of the lungs; and perhaps a ſubſequent ſoftening of the ribs. If your curioſity was in any degree raiſed by this ſingular occurrence, I hope it will be gratified by the following communi-

cation, for which I am indebted to a Gentleman, perfectly well known to you.

Letter from Mr. Yonge, Surgeon at Shiffnall in Shropshire.

SHIFFNALL, April 15, 1793.

DEAR SIR,

You will find ſubjoined a brief ſtatement of the caſe of Miſs Farmer, though I fear not ſufficiently accurate or diſtinct to afford you much ſatisfaction; it is formed from memory, and the information of ſiſters who attended her during the whole time of her illneſs, aided by reference to preſcriptions, and a few imperfect memorandums. It ſeems unneceſſary to detail at length the gradations of her incipient diſeaſe--they were the ſame as in other phthiſical caſes---or the ſucceſſion of inefficacious medicines employed. I ſhall only remark that during the few firſt weeks, the patient was more reduced in fleſh and ſtrength than the apparent ſeverity of the ſymptoms, or the means uſed for her relief led me to expect; both however were ſomewhat reſtored before ſhe relinquiſhed the uſe of medicine in 1775, though without any abatement of the cough or expectoration. I am unable to diſcover at what time the depreſſion of the cheſt commenced, or the exact period of its increaſe or termination.

Your's Sincerely,

To W. YONGE.

Dr. Beddoes,
Briſtol Hotwells.

" Mary Farmer, of a ſpare habit, and hectic " appearance was attacked at the latter end " of the year 1773 with cough, pain in the " left ſide of the thorax, and ſlight feveriſh " ſymptoms.---Theſe complaints were alleviated by bleeding, ſaline medicines, and bliſters----but after a few weeks introduced " phthiſis pulmonalis, which though mild in its " appearance, was diſtinct and perfectly formed.

"During the period between this attack and "the middle of the year 1775, the medicines "chiefly employed and repeatedly varied "were---gentle emetics of ipecacuanha, opi-"um, Peruvian bark, vitriolic acid with con-"ſerve of roſes, and fixed air taken into the "ſtomach, none of which gave her permanent "relief. In this interval alſo it was obſerved "that ſome diſtortion of the thorax had taken "place, from depreſſion of the ribs on the left "ſide. The expectoration was not more than "three ounce meaſures every twenty-four hours, "of perfectly purulent matter, untinged with "blood. The night-ſweats and pain conſtant, "but not ſevere.---Theſe circumſtances con-"tinued until the year 1779, without variation, "when ſhe tried the air and waters of Briſtol "without advantage, and in 1780 repeated "ſome of her former medicines with no better "ſucceſs. The depreſſion of the left ſide of "the thorax was now very great, but did not "increaſe after this time; and the diſeaſe in-

" creaſing by almoſt imperceptible gradations, " ſhe died in September 1785, without the " intervention of any unuſual circumſtance."

In this caſe, you ſee, the patient lived between ten and eleven years after the depreſſion of the ribs. Mr. Portal, the French anatomiſt, relates a caſe where the progreſs of Conſumption was remarkably ſlow, and where *la cavité droite de la poitrine ſut trouvee absolument depourvue de poumon, en sorte que les trois lobes en etoient entierement detruits. La bronche droite etoit racornie et dessechè comme un ligament. On doit remarquer qu' il n'y avoit aucune espece d' epanchement dans cette cavite; ce qui indique que cette destruction du poumon s'etoit ſaite depuis long temps & vraisemblablement depuis quatre ans.* (*La Medecine eclaireé, par Fourcroy I.* 207.)

You muſt have ſeen inſtances where the progreſs of Conſumption has been remarkably ſlow. I do not know whether you have remarked any correſponding peculiarity, internal or external.

The

The other variety of Conſumption ſets in at leaſt with very different ſymptoms, though I believe in its progreſs the higher oxygenation of the ſyſtem takes place: The ruddineſs, at leaſt, of the tongue is conſpicuous at an advanced period of the diſeaſe (*d*). This variety has been called, on account of the prodigious expectoration of mucus at its commencement, the *pituitous* or *catarrhal* Conſumption. I have ſeen the countenance pale and bloated, and ſeemingly but not really œdematous, in the firſt ſtage. In one recent inſtance where a very copious expectoration of mucus preceded for a long time the appearance of pus and the formation of the regular hectic fever, this fever vaniſhed together with the purulent expectoration; and a true anaſarca, not a mere œdematous

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(*d*) *Accedit* tandem *febris primum erratica, horroribus calori crebro intersertis, dein plerumque post pastum accedens, tandem uno ferè tramite decurrens, post meridiem et vesperam versus exasperata. Quæ postquam impetiit, macies celeri gradu increscit, siti hand parum molestâ, linguâ purâ quin* rubicundâ, *sputis subinde adeo tenacibus ut suffocationem minentur.*

Murray de phthiſi pituitoſâ, § 7.

œdematous ſwelling of the feet from weakneſs, came on. You know what has been written on this variety of Conſumption, and for the preſent I ſhall content myſelf with referring readers, not ſo well informed, to Huxham (*e*) Chalmers (*f*) Duncan (*g*) and Macbride (*h*).

SEVERAL YEARS AGO a firm perſuaſion ſettled upon my mind that the ſyſtem might be as powerfully and as variouſly affected by means of the lungs as of the ſtomach. And the more knowledge we have acquired of the properties of elaſtic fluids, the more has my opinion been ſtrengthened. Of all the functions, Reſpiration is, I think, the beſt underſtood; and it will alſo be found in ſkilful hands to be the moſt eaſily manageable. It is impoſſible to doubt that we are nouriſhed by the lungs as truly as by the ſtomach; and that what we take in at the for-

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(*e*) De aere and morbis.

(*f*) Diſeaſes of South Carolina.

(*g*) Medical caſes.

(*h*) Theory and Practice of Phyſic.—See alſo De Haen R. M. xv.

mer entrance becomes like our food a part of the ſubſtance of our ſolids as well as of our fluids. By the lungs we can alſo introduce effectual alteratives of the blood, and by conſequence of all the parts nouriſhed by the blood.

Early in the courſe of my medical ſtudies I met with the writings of Mayow(*i*); and not long afterwards I became intimate with Dr. Edmund Goodwyn, to whom we owe a moſt maſterly experimental

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(*i*) In the abſtract which I publiſhed of Mayow's phyſiological and chemical writings, I expreſſed myſelf in the following manner: "That the blood departs from the left or poſterior cavities of the "heart, richly laden with nitro-atmoſpherical ſpirit (oxygene) and "returns deſtitute to the right, ſeems ſufficiently eſtabliſhed; "and that it is more impoveriſhed, as it approaches nearer the "end of its circuit, is highly probable. From the frequency of "reſpiration it is evident that much of this principle is received; "and much therefore is left behind for the conſumption and uſe "of animal œconomy; and ſurely it ſerves other purpoſes beſides "keeping up the play of the left ventricle of the heart. If we "conſider further that the fœtus, though it can live without "reſpiration, muſt nevertheleſs borrow from the maternal blood, "by means of the placenta, a ſupply of the ſame principle—that, "as our author obſerves, the tranſmiſſion of the blood can never "be the ſole object of reſpiration, ſince this object might have "been accompliſhed by continuing the organization of the fœtus—

experimental inveſtigation of the function of reſpiration. Theſe circumſtances led me to reflect with peculiar earneſtneſs upon the action of the atmoſpheric air on the blood during its paſſage through the lungs; and at Edinburgh I made or witneſſed many experiments upon animals, tending to illuſtrate this important ſubject. Being afterwards appointed to the Chair of Chemiſtry in the Univerſity of Oxford,

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"and how much blood goes to the ſecretory organs and the "brains—from the whole we may ſafely infer that theſe data "will one day conſpire with future diſcoveries in chemiſtry to "unravel the myſterious operation of theſe organs. And the "MAYOW of another age, by explaining, and perhaps alſo by "teaching how to manage their intricate and multifarious "machinery, may ſee that art, which can reſt firmly upon no "other foundation than a juſt theory of the functions of the "body, riſing under his hands into a beautiful and ſolid ſtructure. "Nor, however remote MEDICINE may at preſent be from "ſuch perfection, do I ſee any reaſon to doubt that, by taking "advantage of various and continual acceſſions as they accrue to "ſcience, the ſame power will be acquired over living, as is at "preſent exerciſed over ſome inanimate bodies; and that not "only the cure and prevention of diſeaſes, but the art of pro-"tracting the faireſt ſeaſon of life and rendering health more "vigorous, will one day half realize half the dream of "Alchemy."

Chemical Experiments and Opinions, 1790, *p.* 60, 61.

Oxford, I found myſelf obliged to acquire as minute a knowledge of the properties of elaſtic fluids as poſſible.

From the moment I became acquainted with the effects of pregnancy in ſuſpending the progreſs of Conſumption, I conceived hopes that by combining this fact with the diſcoveries daily making in pneumatic chemiſtry, a ſucceſsful method of treating this diſeaſe, in ſome of its ſtages at leaſt, might be deviſed. During the ſame interval the idea of turning theſe diſcoveries to the benefit of conſumptive patients occurred to others: And ſeveral attempts, not abſolutely unattended with ſucceſs, were made to palliate their ſymptoms. But they were random trials, guided by no fixed principle; and, if we except thoſe of Dr. Fourcroy, it was impoſſible that they ſhould have been ſucceſsful, even if the means, properly employed, had been adequate.

In the mean time, my own reflections, aided by information obtained from various quarters, ſuggeſted to me an opinion concerning Conſumption, which leads to a method of practice totally different from any hitherto employed. And you, I am ſure, will not judge more unfavourably either of the theory or practice on this account. Juſt before the publication of my OBSERVATIONS, in which the theory is ſtated at length, an opportunity offered of bringing it in ſome degree to the teſt of experiment. The writer of the following letters, (who, you know, has been long extenſively engaged in the practice of medicine) brought me his ſon, at that time far gone in a Conſumption of the lungs. I propoſed that he ſhould breathe a mixture of airs, and be put upon a diet, conformable to my views. The father, convinced of the utter inſignificance of all the ordinary means of cure, chearfully conſented. An apparatus in itſelf very imperfect, but as good as the time and place would admit, was accordingly ſet up in an apartment of a common dwelling-houſe. But as the perſons, who uſed it, had never been accuſtomed to the proceſſes of pneumatic chemiſtry, it was unfortunately often out of order; and as it was neceſſary to ſend ſeven miles (to W. Hampton) to have it repaired, the patient was often three or four days, or even a week deprived of his modified air: And he paſſed upon the whole four or five times as many days entirely without it as with it; and when he did uſe it, the ſupply of air was infinitely more ſcanty than I could have wiſhed. Yet even ſo, the effect exceeded my moſt ſanguine expectations. And I cannot but ſuppoſe that if the effect of a larger ſupply had kept any proportion with the effect of the ſmaller, and if I had fallen upon the ſame plan of medical treatment and of diet that has ſince occurred to me, his life, even in that advanced period of his diſeaſe, might have been preſerved.

Letter from Mr. Crump, Surgeon and Apothecary, at Albrighton, in Shropſhire:

ALBRIGHTON, May 29, 1793.

Dear SIR,

I am very ſorry it was not in my power to give you any ſort of hiſtory of the caſe of my ſon by the meſſenger you ſent, not having committed any thing to paper relative to him, but the opinion of ...., given about four years and a half ſince, at which time he recovered in ſome meaſure at leaſt from his fever, pain in his ſide, &c. The cough, however, never left him, but was of little conſequence, except he took freſh cold; and then his fever and expectoration always returned with violent fits of coughing---but in general ſoon ſubſided by his obſerving rules nearly ſimilar to what had been previouſly followed---until ſuch time I brought him to you; and I hope you will not think me guilty of flattery, when I tell you that I am very well ſatisfied, that if your method of living with the free uſe of the mixed air had been entered upon ſooner, we ſhould have ſaved him---I can only add that whenever we could procure the air properly, he was always moſt wonderfully relieved not only by diminiſhing the expectoration, *but evidently the fever, &c. On thoſe unfortunate days that we did not ſucceed (which was too often the caſe either from my other engagements, as alſo thoſe of my aſſiſtant when in the purſuit of unavoidable buſineſs---or at other times from our lutes failing, ſo that we could not keep the air confined) the poor boy uſed frequently to aſk me for ſome of Dr. Beddoes's breath---for the little

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* If he was without the air for two days the fœtid ſtate of his breath was ſure to return with a conſiderable increaſe of the matter coughed up, which ſeemed always to be in a declining ſtate ſo long as we could procure the air—and even continued ſo to the laſt without variation---his appetite and reliſh for animal food conſiderably better during the time he inſpired.---Previous to his leaving the inſpiring off, he was ſeized with a violent fit of coughing, which brought up a quantity of red blood, which was ſucceeded by a great profuſion of matter, which was literally pumped up, and ſo much reduced him that he was not able to ſit up, and we could not convey the air into his lungs in bed.

little he had was almoſt gone. And I cannot in juſtice to you do otherwiſe than inform you that his dyſpnæa and expectoration of matter were always relieved by two or three inſpirations---and more ſo than by any medicine I ever gave him, or ever ſaw adminiſtered to others labouring under the ſame complaints.

Another thing I muſt obſerve, that the poor boy always regretted the loſs of blood---as you ſeemed to think it an improper mode of proceeding in Pulmonary Conſumption.

I wiſh very much to hear from you at ſome future period upon this buſineſs, and if you will be kind enough to point out any defect in the information I here ſend you, I will gladly anſwer you, as I can ſend you to Briſtol any further account in franks---at the ſame time I ſhall be happy to know if you have made any further trial of this promiſing plan for relieving this dreadful malady.

An obſervation I made during the time G. Crump inſpired the air, is perhaps worth notice---at leaſt I ſhould wiſh to know if it produced the ſame effects in others, that is, in a morning previous to his uſing it his breath was moſt abominably fœtid---that after uſing it two or three times it became not only very eaſy, but alſo very ſweet, and continued ſo, ſometimes for two or three days---he alſo told us at the firſt inſpiration, whether it would relieve him or not, by ſaying he would not tire himſelf, for that it was not of the right ſort---though the bell ſhaped inſtrument roſe with the uſual regularity in the water: I am not chemiſt ſufficient to explain this †. I beg you will excuſe the haſty manner in which I have ſent you the above account; and hope you will remember that I ſhall have a pleaſure in anſwering any further enquiry you may wiſh to make---at the ſame time beg leave to tell you, that I have a heart replete with gratitude for your kind aſſiſtance to my poor boy,---and remain,

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† The hydrogene air having been procured ſometimes by means of heated iron, and ſometimes by means of charcoal, it is propable that ſome impurity, (as a proportion of ſulphur in the iron larger than ordinary, or of bitumen in ſome pieces of charcoal not well burned) might have produced that air, which the patient felt not to be of the right ſort.

T. B.

Dear Sir, your's truly,

To GEORGE CRUMP.

Dr. BEDDOES.

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Extract of a second Letter from Mr. Crump:

ALBRIGHTON, June 2, 1793.

Dear SIR,

I conceive, as nearly as we can trace back by the medicines my ſon took, &c. that it might have been about a year and a half that he laboured under the ſymptoms of Phthiſis Pulmonalis. The quantity of factitious air was as nearly as poſſible as one to two of atmoſpherical----ſometimes, I think a little more atmoſpheric air; but towards the laſt of his uſing it, it was almoſt equal or it did not pleaſe him.----I imagine the immediate eaſe he always received from it made him extremely anxious to have it, what he called good.

I am, Dear Sir,

Your moſt obedient ſervant,

To GEORGE CRUMP.

Dr. Beddoes.

Mr. Yonge curious to ſee the effect of ſo ſingular a method of treating conſumption, once accompanied me when I viſited this patient, and has ſupplied me with the following memorandum:----"The account, given by Mr. "George Crump of his relief from the uſe of "the pneumatic machine was: *that on the days* "*of its application the cough, dyspnœa, and* "*expectoration were invariably and greatly re-* "*lieved---and his nights less restless and feverish.* "*Indeed his eagerness for the renovation of his* "*disordered*

" *disordered apparatus left no doubt of the fidelity*
" *of his testimony, so fully confirmed to us by*
" *his father.*"

W. Yonge.

I do not know whether you will allow that the circumſtances of this caſe offered a reaſonable inducement to proſecute this method of treating conſumption. With me they were particularly calculated to weigh, as they ſeemed to give as much countenance as could poſſibly be expected to my reaſonings; in which I had even ventured to ſuggeſt that it would be more advantageous to lower the atmoſpheric air with hydrogene than with azotic air, becauſe the hydrogene has been obſerved in experiments made upon blood out of the body " to have the power of darkening its colour" (*Observations p.* 141), becauſe blood abſorbs a good deal of this air, and becauſe when inſpired, it is found to " poſſeſs no irritating " quality," a fact, which I hope to eſtabliſh to your ſatisfaction below. The experience of

Dr. Percival, who found that carbonic acid air alleviated the ſymptoms of conſumption, and ſtill more that of Dr. Fourcroy, who obſerved them in not leſs than twenty caſes to be exceſſively aggravated by the inſpiration of oxygene air, contributed to induce me to try fully whether this method, which I now certainly knew to be ſafe and more palliative than any other, might not alſo in ſome ſtages hitherto hopeleſs, effect a real cure. After ſome heſitation, Briſtol Hotwells was fixed upon as the moſt proper place to erect the neceſſary apparatus, becauſe this reſort of invalids ſeemed more likely than any other ſituation to furniſh patients in all the various gradations of Conſumption.

In the conſtruction of the apparatus three eſſential objects were to be accompliſhed: 1. To provide the means of procuring the ſeveral ſpecies of air, at leaſt azotic, hydrogene, carbonic acid, and likewiſe oxygene, for I had no intention to confine myſelf to one incurable diſorder, as you will infer from my former ſpeculations, eſpecially what I have ſaid concerning Fever. 2. It was neceſſary that the reſervoirs ſhould be ſo large that the patients might be ſupplied with any quantity their ſymptoms might require. 2. It was alſo neceſſary to have it in my power to mix theſe airs with one another as well as with atmoſpheric air in any proportion.

Theſe objects have been compleatly attained by a conſtruction not very diſſimilar to that employed in the gazometers of Mr. Lavoiſier and Dr. Van Marum. I once thought it would be deſirable to introduce patients into rooms filled with modified air; and if this plan could be eaſily carried into execution, it would be preferable to inſpiration through a pipe or mouthpiece. But there would be ſome difficulty and much expence in fitting up ſuch rooms; nor I am ſure that they would be ſo totally exempt from danger; beſides experience has convinced me that patients very ſoon learn to inſpire through a tube, held in the mouth, and to expire through the noſtrils. They are indeed at firſt apt to reſpire with a greater effort than ordinary; but even in this particular they very ſoon correct themſelves.

I once thought of annexing drawings of my apparatus to this letter. But as I am in hopes of being ſoon furniſhed with materials for another publication upon the ſame ſubject, and as in the mean time the apparatus will hardly fail to receive conſiderable improvements, I concluded that it would be more adviſeable to defer the engravings for a few months. I have however provided a model for the inſpection of ſuch perſons on the ſpot as may be intereſted in acquiring an accurate idea of the method of treatment. I have alſo found it neceſſary to provide a portable apparatus for the uſe of patients unable to quit their beds or their apartments: And of this alſo I intend to publiſh a drawing and a deſcription. It may perhaps be ſaid that I ſhould have done better if

I had delayed all public notification of the exiſtence of the apparatus, till I had certainly determined the efficacy of the practice in which it is deſigned to be employed. But in the firſt place, it will be neceſſary for me to have the care of a conſiderable variety of caſes before I can determine its efficacy with certainty; and I could not expect this advantage till the nature of the deſign was generally known through the kingdom. Secondly, I did not chooſe to truſt to unauthorized rumour to make it known; and, in the third place, I imagine there are many practitioners of medicine ſo convinced of the futility of all former methods of treating Conſumption, as to be deſirous that their patients ſhould have the chance of any new method that affords hopes of relief, and is aſcertained to be ſafe and not diſagreeable; a ſentiment in which I ſuppoſe many patients will concur: And in proportion to the efficacy of the method, will be the number of lives preſerved by making it ſpeedily known. I may add, that the expence of keeping ſuch an apparatus in uſe is not inconſiderable; of courſe I muſt wiſh to be able as ſoon as poſſible to form a judgment whether it would be prudent to lay it aſide, or to extend it.

Of the three Airs above mentioned, I hope the moſt from the employment of hydrogene to reduce the air of the atmoſphere to a lower ſtandard. From a number of trials it appears to be ſo totally free from all irritating and poſitively deleterious properties, that it may be breathed unmixed with impunity for a much longer time than any other of thoſe airs that are incapable of ſupporting life, except perhaps azotic. Thus Mr. Scheele tells us that having by a ſtrong expiration expelled from his lungs as much atmoſpheric air as poſſible, he was able to make twenty inſpirations without inconvenience. Pilatre de Rozier frequently repeated the ſame experiment; and when it was objected to him that he did not empty his lungs of atmoſpheric air, he proceeded in the following manner. He inhaled a large quantity of hydrogene air, and then, applying his mouth to a tube, he blew out the air and fired it at the end of the tube, ſo that he appeared to breathe flame. In this caſe, he obſerved, if there had been any admixture of atmoſpheric air in his lungs, a detonation muſt have taken place in his mouth and cheſt. I have myſelf felt the pulſe of Mr. Sadler, the *Engliſh* Aeronaut, while he has inſpired, for above a minute and half at a time, pure hydrogene air from ſteam and heated iron. From the rate of eighty-four in a minute it increaſed to an hundred and ten in fifteen ſeconds, and became ſoft and weak. A ſtout florid young woman breathed the ſame air for two minutes, during which ſhe made twenty-ſix inſpirations. She was not in the ſmalleſt degree affected, till ſhe had walked down a flight of ſtairs. She then felt ſome ſickneſs, and her head became a little dizzy and continued ſo for two hours, after which ſhe felt perfectly well. Two other perſons on the ſame occaſion made ſeveral ſucceſſive full inſpirations of this air without the ſlighteſt inconvenience. It was inhaled through a tube, and in conſequence of preſſure on the reſervoir, a ſtrong current ſet into the mouth. The noſtrils were not cloſed in any of theſe inſtances. A ſmall quantity of atmoſpheric was therefore probably inhaled with the hydrogene air.----Hydrogene is ſaid, when animals are immerſed in it, to be as ſuddenly deleterious as carbonic acid air: *(Priestly's Exp. New Ed. I. 229)* and as ſuch experiments, if accurately made, are certainly the moſt deciſive, I have perhaps expreſſed myſelf too ſtrongly in aſſerting "that it ſeems pretty well aſcer-"tained that hydrogene will not ſo ſoon pro-"duce aſphyxia as other mephitic airs." Nevertheleſs in ſome inſtances which I have known of inſenſibility produced by the fumes of charcoal, I conceive that the ſufferers muſt have breathed a mixture containing more atmoſpheric air than the perſons above mentioned.

tioned. Carbonic acid air may be ſuſpected ſomewhat to accelerate aſphyxia by the irritation it produces. Nitrous air evidently does ſo by forming nitrous acid: When Dr. Prieſtly put fiſhes into water impregnated with nitrous and other airs, he found the former to have a more immediately deleterious effect. The difference, if any exiſts, might be aſcertained by obvious experiments on ſome of the ſmaller of the warm blooded animals.

It is a curious, and to me an agreeable circumſtance that animals may be gradually inured to air with leſs oxygene than uſual. In the caſe of phthiſis related above, the patient continually demanded more and more hydrogene air; and can you doubt that the human frame poſſeſſes the ſame power of adapting itſelf to a change of circumſtances that has been diſcovered in inferior animals, which reſpire in the ſame manner? *(Prieſtly III. 257.)*

Since my Apparatus has been at all fit for uſe, I have employed hydrogene air in one pulmonic caſe; and the reſult has been ſatisfactory. A perſon of fair complexion and dark eyes had been for ſome time paſt ſubject to attacks of hæmoptyſis attended with dyſpnœa, ſevere coughing, and pain in the thorax. On a late ſeizure of this kind I adviſed the uſe of modified air. The pulſe was hard, from an hundred and four to an hundred and eight. The countenance much fluſhed; the ſkin dry and hot, with conſiderable febrile rigour. All her feelings the ſame as at the commencement of former ſeizures. She began by breathing three hundred and fifty-ſix cubic inches of air; of which forty-four (nearly one-eighth) we hydrogene from ſteam and red hot iron. This quantity ſhe conſumed in fifteen minutes. When ſhe ſat down to inſpire, ſhe had very acute pain under the ſternum; which entirely ſubſided while ſhe was breathing. The pain afterwards returned, but with leſs violence; and upon inſpiring from ten to fifteen minutes at a time ſeveral times a day for three days, it entirely diſappeared with the other ſymptoms.-- It had before occurred to me that air of a reduced ſtandard would be extremely beneficial in ſthenic inflammation; and I am confirmed in the opinion by this inſtance.

I have ſeveral times ſeen the ſhort dry cough ſtopped at once by air ſimilarly modified. But without further experience I dare not affirm that it was owing to the medicinal power of the mixture, ſince we ſo frequently ſee morbid affections of the body ſuſpended by a change in the ſtate of the mind.

Should I find it neceſſary to ſubſtitute azotic in the place of hydrogene air, the accidental diſcovery (which I made a few years ago, and which is announced in Dr. Crell's *Chemical Annals* for 1790) of a ready method of procuring this ſpecies of elaſtic fluid by efferveſcence will, I truſt, prove ſerviceable. Nothing but the want of a few more experiments to aſcertain which of ſeveral variations of the proceſs is the beſt, and what quantity is afforded by the different proceſſes, has prevented me from ſubmitting an account of my method to the Royal Society; and whether I ſhall have occaſion for this air for medical purpoſes or not, I hope ſoon to be able to bring my experiments to a concluſion.

After ſecuring a full ſupply of oxygene air, the firſt thing I undertook, was to attempt to throw ſome light upon the nature of Conſumption by an experiment upon myſelf. Not having any thing of the phthiſical conformation or the ſlighteſt hereditary claim to the diſeaſe, I thought I might venture very far in oxygenating myſelf without any great riſque; and it was impoſſible for me to obſerve the effects ſo minutely in another perſon. I accordingly reſpired air of a much higher than the ordinary ſtandard, and commonly ſuch as contained almoſt equal parts of oxygene and azotic air for near ſeven weeks with little interruption. I breathed it upon the whole ſometimes for twenty minutes, ſometimes for half an hour, and ſometimes for an hour in the day, but I never continued breathing for above four or five minutes at any one time. I felt, at the time of inſpiration, that agreeable glow and lightneſs of the cheſt, which has been deſcribed by Dr. Prieſtly and others. In a very ſhort time I was ſenſible of a much greater flow of ſpirits than formerly, and was much more diſpoſed to muſcular exertion. By degrees, my complexion, from an uniform brown, became fairer and ſomewhat florid. I perceived a carnation tint at the ends of the fingers, and on all the covered parts of the body the ſkin acquired much more of a fleſh colour than it had before. I was rather fat, but during this proceſs I fell away rapidly, my waiſtcoats becoming very much too large for me; I was not ſenſible however, of any muſcular emaciation, but rather the contrary. My appetite was good;

and I eat one-third or one-fourth more than before without feeling my ſtomach loaded. In no long time I obſerved in myſelf a remarkable power of ſuſtaining cold. Except one or two evenings when I was feveriſh, I never once experienced the ſenſation of chillineſs, though cold eaſterly winds prevailed, during great part of the time I was inſpiring oxygene air. I not only reduced my bed clothes to a ſingle blanket and cover-lid, but ſlept without inconvenience in a large bed-chamber, looking to the N. E. with the window open all night, and with the door and windows of an adjacent ſitting room alſo open. About the expiration of the above-mentioned time, I perceived ſome ſuſpicious ſymptoms. It was uncomfortable to me to ſit in a room at all cloſe. I frequently felt a ſenſe of heat and uneaſineſs in my cheſt; and my ſkin was often dry and hot with burning in my palms and ſoles; my pulſe, which had hitherto ſeldom exceeded eighty, was above ninety in the evening. At this time

I took a journey of about 170 miles, the greater part in a mail coach in the night, the reſt on horſeback. The roads were uncommonly duſty, and ſeveral circumſtances concurred to harraſs and fatigue me. On the way I met with a medical friend, who was much ſtruck with the fluſhed appearance of my countenance, and upon feeling my ſkin and pulſe, which varied from an hundred and four to an hundred and twenty, imagined that I was become hectic. I had now, though but ſeldom, a ſhort, dry cough; but the ſenſe of irritation to cough required an almoſt conſtant effort to ſuppreſs it; this ſenſe of irritation was, as you will ſuppoſe, attended by dyſpnœa. I had alſo frequent bleedings at the noſe, an event almoſt unprecedented with me; the blood was of an unuſually bright colour; which was alſo ſeen in blood forced from the gums. Whenever I pierced the ſkin in ſhaving, the blood flowed in greater abundance than uſual, and was ſtaunched with difficulty.

Theſe ſymptoms indicate a tendency to hæmoptyſis (*k*), and they, of courſe, ſo ſtrongly corroborate my theory of Conſumption, that I am almoſt afraid leſt they ſhould be conſidered as imaginary or fictitious. I am glad therefore to have it in my power to appeal, for all thoſe circumſtances which could fall under the notice of ſpectators, to teſtimony that will weigh ſo much with you as that of Mr. WILLIAM REYNOLDS, at whoſe houſe at *Coalpit Bank* I was when moſt indiſpoſed, of his brother, Mr. JOSEPH REYNOLDS, and of Mr. W. YONGE. By keeping quiet and cool, and by the aſſiſtance, as I ſuppoſe, of a diet in which ſweet oil, butter and cream bore a large proportion to the other articles, I very ſoon recovered my health. My inſenſibility to cold, as I had an opportunity of aſcertaining, during the evenings we have lately had

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(*k*) HÆMOPTYSIS: *genarum rubor*; *moleſtiæ aut doloris, et aliquando caloris, in pectore ſenſus*; *dyſpnœa*; *titillatio faucium*; *tuſſis aut tuſſicula ſanguinem floridum, ſæpe ſpumoſum rejiciens.* (Cullen Noſolog. II. 156).

had (June 21ſt----24th) ſtill continues; and the change of complexion will probably be permanent; it may at leaſt, I doubt not, be rendered ſo by inſpiring ſmall quantities of oxygene air from time to time.---Is there not alſo room to conjecture, as well from this experiment as from the remarkable tendency of oxygene to generate heat, whenever it enters into combination, that many invalids may be advantageouſly fortified againſt the cold of winter by breathing atmoſpheric improved by the addition of oxygene air? We ſhall not, I hope, be long without a convenient ſmall apparatus for procuring and containing oxygene air; and ſuch an apparatus, I ſhould expect, would ſoon come to be ranked among the ordinary articles of houſehold furniture. In this caſe I think it probable that oxygene air will ſuperſede all other coſmetics; one deciſive advantage it will certainly have over them all, for while it improves the looks, it will, if judiciouſly adminiſtered, amend the health alſo.---In true aſthmatic fits its beneficial effects have been already many times experienced. No ſooner does it touch the lungs than the livid colour of the countenance diſappears, the laborious reſpiration ceaſes, and the functions of all the thoracic organs go on eaſily and pleaſantly again.

As ſo many more diſeaſes ariſe from the defect than the exceſs of vital energy, I expect eſſential benefit from oxygene air in a conſiderable variety of diſeaſes; and I look upon it as fortunate that the inſpiration ſhould be attended with agreeable ſenſations. A mixture of air containing about thirty-five parts in an hundred of oxygene may be employed with probable advantage and with undoubted ſafety in the following diſeaſes: 1. In Typhus, but not perhaps where the excitement of the vaſcular ſyſtem is too great, as long as this ſymptom continues. 2. In Hyſteria, and ſimilar nervous affections. 3. In Anaſarca and Hydrothorax, after the evacuation of the water; in theſe caſes we find the extremities, eſpecially the feet, to be habitually cold, almoſt to inſenſibility; oxygene, I think, would give life and activity to the remoteſt abſorbents, and prevent a freſh accumulation of water. Indeed I ſuſpect that in conſequence of this operation it will be found the moſt powerful and ſalutary of all diuretics. 4. In Diabetes, may not an addition of the acidifying principle to the blood correct the tendency of the kidneys to ſecrete ſaccharine urine; and hence cure this infrequent but fatal diſeaſe? 5. I am not without hopes of being able to repair the injury ſuſtained by the liver from too free a mode of life. In one inſtance where redneſs of the noſe alternated with heavy internal pain about the region of the liver, the natural colour of the noſe has been for ſome time permanent and the pain has diſappeared; but a ſufficient interval has not elapſed, ſince theſe changes took place, for any deciſive opinion to be given upon the caſe. 6. In ill-conditioned Ulcers, eſpecially of the legs, and in ſome of the affections termed ſcrophulous. 7. In Palſy. 8. Does not the leaden complexion in Schirrus indicate a deficiency of oxygene? Superficial readers will perhaps be tempted to charge me with inconſiſtency for imputing diſeaſes, marked by ſuch different ſypmtoms, as ſcurvy, typhus and ſchirrus to a deficiency of the ſame conſtituent part of animal bodies; but you will allow that it is perfectly conſonant to analogy and therefore probable, that diſeaſes, widely differing in form, ſhould be produced as this principle is more or leſs withdrawn, and as it is withdrawn more or leſs rapidly.----Having mentioned ſchirrus, it is ſuperfluous to ſay that oxygene air ſhould be tried in cancer alſo. 9. In Hydrophobia and ſome other deſperate diſeaſes, no one, I ſuppoſe, would object to the trial of various mixtures of air, even though we are totally deſerted by theory.

It is needleſs to continue this enumeration. Every perſon, who underſtands the principles, will be able to continue it for himſelf; and ſucceſs in one will encourage to a trial in other diſeaſes. In a future letter I hope to preſent you with a catalogue of diſeaſes in which I have effected a cure. The power of the various elaſtic fluids, and of a diet and medicines calculated according to the theory, which preſcribes a particular mixture of airs in any given caſe, will I hope, ſoon be determined. There are many diſeaſes in which neither patients nor practitioners have much reaſon to be ſatisfied with the ſtate of medicine; and multitudes will, no doubt, concur with me in endeavouring to put it upon a better footing. Many circumſtances, indeed, ſeem to indicate that a great revolution in this art is at hand. We owe to PNEUMATIC CHEMISTRY the command of the elements which compoſe animal ſubſtances; Now it is difficult not to believe that much depends on the due proportion of theſe ingredients; and it is the buſineſs of PNEUMATIC MEDICINE to apply them with caution and intelligence to the reſtoration and preſervation of health.---And if you do not, as I am almoſt ſure you do not, think it abſurd to ſuppoſe the organization of man equally ſuſceptible of improvement from culture with that of various animals and vegetables, you will agree with me in entertaining hopes not only of a beneficial change in the practice of medicine, but in the conſtitution of human nature itſelf.

THOMAS BEDDOES.

Hope-Square,
Bristol Hotwells,
June 30, 1793.

It is proper to mention, and it may be satisfactory to some readers to be informed, that the preceding remarks on the varieties of consumption were printed before the receipt of the following letter: And as I had never any opportunity of knowing his sentiments on this point before, I could not but be gratified on finding that I had formed nearly the same opinion with a Philosopher, not less distinguished by the talent of observation, than that of invention.

DERBY, Jan. 17, 1793.

Dear SIR,

Your treatiſe on Conſumptions I have read with great pleaſure, and am glad to find you are about to combat this giant-malady, which has hitherto baffled the ſkill, and withſtood the prowеſs of all ages; and which in this country deſtroys whole families, and, like war, cuts off the young in their prime of life, ſparing old age and infirmity.

The few obſervations I have made on this diſeaſe, ſince you requeſt them, are at your ſervice; as I wiſh to contribute even a mite to your great deſign. I hope you will be led to try a variety of experiments with mixtures of airs; your very ingenious reaſonings from the ſcarlet colour of the blood in conſumptive patients, and from the inflammatory ſize or coagulable part of it, and from the delay of the progreſs of conſumption in pregnant women, indicate indeed hyperoxygenation to be the cauſe of this fatal diſeaſe. But by inſtituting other experiments with different kinds or proportions of airs, you will, at leaſt, if your firſt experiments ſhould not ſucceed to your utmoſt wiſh, hold out hopes to thoſe unfortunate young men and women; who, if they knew the general fatality of their diſeaſe under the preſent modes of treatment, would deſpond at the commencement of it, or wiſh to try ſome new kind of medicine: For though catarrhs are ſometimes miſtaken for conſumptions by the ignorant, or are deſignedly called ſo by the crafty, and are hence ſuppoſed occaſionally to have been cured; yet it is well known to attentive practitioners, that thoſe patients, who are truly conſumptive from pulmonary ulcers, which have ariſen ſpontaneouſly, (and are thus diſtinguiſhable from a ſingle ulcer owing to violent peripneumony, or the wound of a ſword)---whether they are kept on vegetable or on animal diet; and whether, with the uſual quantity of wine and beer, or with water and milk alone---at length ſubmit to fate; and that generally with many of their relations by heriditary prediſpoſition, or with their neareſt friend by contagion.

The immediate caſe of Pulmonary Conſumption conſiſts in ulcers of the lungs; theſe ulcers, whether they ariſe ſpontaneouſly, or from previous infection, may vary in reſpect to their ſeat, as well as to their remote cauſe; but I ſuppoſe the immediate cauſe of theſe ulcers to conſiſt in the inirritability of either the lymphatic or of the venous ſyſtem. Firſt, if the mucaginous fluid, which is poured into the cells of the mucous membrane of the lungs be not perfectly abſorbed, it will produce ulcers by its accumulation, or by its chemical change. Secondly, if the blood brought to the internal ſurface of the bronchia by the bronchial arteries be not perfectly abſorbed, or taken up by the correſpondent bronchial veins, hæmoptoe will be induced, and ſmall ulcers ſucceed in conſequence.

Hence there has always appeared to me to be two kinds of Pulmonary Conſumption, one which begins with ſlight hæmoptoe and which is generally ſeen in dark-eyed people with large pupils; and the other, which commences without hæmoptoe, and which is generally ſeen in light-eyed people with large pupils. The aperture of the iris in both theſe kinds of Conſumption is generally large, which evinces the inirritability of the eye, and thence perhaps in conſequence the inirritability of the whole ſyſtem. The former of theſe conſumptions is generally heriditary without any appearance of ſcrophula; and the latter with appearance of ſcrophula in the preſent, preceding, or third generation upwards. The former commences more certainly between ſeventeen and ſeven and twenty; the latter attacks people of all ages.

I believe both theſe Conſumptions to be infectious to thoſe who ſleep with ſuch patients in the laſt ſtage of the diſeaſe; as I have obſerved a huſband in two caſes begin to be diſeaſed ſoon after the death of his wife; and in one a wife, who became conſumptive ſoon after the death of her huſband; in all which caſes there was no reaſon to ſuſpect hereditary prediſpoſition.

The hæmoptoe generally begins at its firſt attack during ſleep, for as reſpiration is in part a voluntary action during our waking hours, and as the power of volition is totally ſuſpended in perfect ſleep, the blood in the lungs of irritable or weak people is liable to accumulate for want of the aid of the voluntary power at that time, and hence hæmorrage enſues; and the ulcers are produced in conſequence of the rupture of the bronchial veins, and of ſome part of the effuſed blood ſtagnating in the air-veſſels, and undergoing a chemical change.

Large abſceſſes frequently exiſt many weeks—ſo long as they are precluded from any acceſs of air without occaſioning hectic fever; but on their ſurfaces being expoſed to the contact of the air by opening them, hectic fever is occaſioned in a very few hours. From this cauſe ariſes the advantage of opening large abſceſſes by means of a ſeton paſſed through them. Hence where a wound is required to heal by the firſt intention (as it is called) as in compound fractures, it muſt carefully be confined from any acceſs of air. And hence laſtly the reaſon, why ulcers of the lungs are ſo difficult to heal, viz. becauſe they are perpetually expoſed to a current of air. What part of atmoſpheric air is hurtful to ulcers, whether it be the oxygene in too large a quantity, as your ingenious reaſonings ſeem to countenance; or too great a proportion of azotic air, I hope your cautious experiments and your particular attention to conſumptive patients will ſoon decide.

One agreeable circumſtance attending your application of different kinds of air to conſumptive people is, that they may at the ſame time perſiſt in any plan of medicine or diet, which theirſelves or their friends for them are ſolicitous to purſue, without interfering with your remedy which is immediately applied to the ſeat of the diſeaſe, and the ulcerations of the lungs.

Go on, dear Sir, ſave the young and the fair of the riſing generation from premature death; and reſcue the ſcience of medicine from its greateſt opprobrium.

Your's, &c,

To E. DARWIN.

Dr. Beddoes.

P. S. Dr. Wood of Newcaſtle has juſt publiſhed a theory of Typhus, varying but in terms from that which I had before given in the book ſo often quoted. He thinks that typhus is produced by "the *accumulation* or *over-proportion* of carbone and hydrogene, and an exhauſted ſtate "of irritability." I ſuſpect that ſuch an accumulation would require more time than the production of this fever

ever takes; and I ſtill think it much more probable that the oxygene is ſuddenly diminiſhed by the action of contagion, or of the ſtimuli, that operate like contagion. This phyſician from experience recommends nitre in typhus. We know how much nitre was a favourite medicine with the Stahlian ſchool; and though it has been of late almoſt entirely diſregarded, I have reaſon to believe that it will prove a medicine of great uſe, now we have a rule for its adminiſtration; and I will not loſe the preſent opportunity of repeating the wiſh I formerly expreſſed, that nitre and acid of tartar might be both employed in ſea ſcurvy.

Carbonic matter long ſince preſented itſelf to my mind as likely to be ſerviceable in diſeaſes, where we ſhould deſire to deprive the ſyſtem of oxygene. Its great attraction for oxygene in high temperatures has long been known; and the experiments of Mr. Lowitz, and ſtill more the very ſurpriſing ones of Dr. Kels (*Crell's Annalen St.* 3, 1792) and of Dr. Buchholz (*Gren's Journ. der Physik B.* v. *p.* 3.) ſhew that at a temperature conſiderably below that of warm-blooded animals, carbonic matter is by no means ſo inert a ſubſtance, as it has hitherto been reputed. Dr. Moench (*V. d. arzney-mitteln p.* 221) aſſures us that he has given it largely with ſucceſs; and the *spongia usta*, though in my opinion a bad preparation and in general too ſparingly adminiſtered, has been thought ſerviceable

viceable in ſcrophula. I have lately given it in a form more capable of being acted upon by the powers of digeſtion than that in which it commonly appears: And, as I believe, with effect. One patient in this neighbourhood had a ſhort, dry cough, pain in the thorax, heats with occaſional ſhiverings, amenorrhœa, fluſhed countenance at times, quick pulſe, and with other ſigns of tubercles threatning ſuppuration---at leaſt of imminent phthiſis; of which diſeaſe ſome of the family had died. I propoſed the inſpiration of modified air; but as the apparatus was not ready for uſe---and it will not indeed be *perfectly finished* before the end of the preſent week---I attempted to retard the approach of the diſeaſe by carbonic matter. The patient grew gradually better, and for ſome weeks has had no phthiſical ſymptom. I am now employing the ſame means in confirmed phthiſis; and as ſoon as I can form an opinion concerning the beſt mode of preparation, and the efficacy, of the medicine, I will publiſh it.

Since this letter has been in the preſs, a patient whoſe principal ſymptoms are too great ſecretion of bronchial mucus, and dyſpnœa on walking up even a ſlight aſcent has been reſpiring air containing about thirty-ſix parts of oxygene air in an hundred. He is already ſenſible of ſome relief in his breathing, though he has hitherto reſpired only for five minutes at a time twice a day. And the hands and covered ſkin, which were before too pale, are, he thinks, becoming more coloured. There can ſcarce indeed be a doubt concerning this effect of oxygene air. Dr. Fourcroy expreſsly mentions the heightening of the complexion in the patients who breathed it under his inſpection; and this might have been fully expected from the change which blood undergoes, when brought into contact with oxygene air; which, if ſuch an expreſſion were allowable, deſerves to be conſidered as the true *sweetner* or *purifier* of the blood. Mr. Chaptal experienced great benefit from this air in a caſe of humoural aſthma* ſimilar to that which I have mentioned laſt.---To what I have before ſaid of the convulſive cough preceding phthiſis, it may be added that in Dr. Fourcroy's patients when the diſeaſe returned with increaſed violence, the firſt ſymptom was a dry, convulſive cough: It is remarkable that both Fourcroy and Chaptal uſed oxygene air unmixed with atmoſpheric. This can ſcarce be proper in any caſe---Inſtances may occur in which an eaſy method of oxygenation might be practiſed. We draw in at every inſpiration about twelve cubic inches of air at a medium. By a full inſpiration after a careful expiration we can inhale two hundred cubic inches. Hence by a moderate effort we can take in from ſixty to an hundred cubic inches. Thus we ſhall bring more air than uſual within the attracting diſtance of the blood; and by continuing this proceſs, oxygenate the ſyſtem. The effect will be promoted by ſlow inſpirations and quick expirations. I have thus in a few minutes often produced a more general glow and higher colour on the cheeks than I could impute to the mere increaſe of muſcular exertion.----I ſubjoin a few queries.---1. Does not the iris generally become more contracted juſt before and juſt after phthiſis? 2. Though it is impoſſible not to perceive the acuteneſs of the argument from the habitual dilatation of the pupil to the inirritability of the ſyſtem, do not ſome appearances ſhew more deciſively ſtill that the ſyſtem about the beginning of conſumption is highly irritable? Do we not for inſtance find that ſtimulants, as fermented liquors, ſet ſuch perſons all on fire? I have ſometimes obſerved a meal of ſolid food without even ſmall beer produce a flow of ſpirits apparantly greater than a moderate quantity of wine would in health. In florid conſumption in ſhort, before great debility comes on, do not weak ſtimuli induce diſagreeable burnings, hard pulſe, &c.?---Even ſo, I do not underſtand why in an irritable ſtate of the body, the iris ſhould be unirritated. 3. Do not Dr. Fourcroy's caſes compared with thoſe above related render it probable that the atmoſpheric oxygene, and not its azote, is prejudicial to ulcerated lungs, and ſo far ſolve Dr. Darwin's problem? 4. It is common in France, and, I believe alſo in Ireland, to lodge phthiſical patients in cow-houſes, on the ſuppoſition that the ſweet breath of the cow is healing and balſamic. *L'air des etables de bêtes à cornes*, ſays Dr. Metherie, *est assez pur pour que la medicine ait cru pouvoir le conseiller dans les maux de poitrine (Airs. 1788. II. 13.)* But if it be beneficial, is not the effect much more probably owing to the ſubtraction of oxygene by the reſpiration of the animals?

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* Believing that this air would be beneficial whenever *le poumon est engorgè par des humeurs pituiteuses*, *J'ai essayè*, ſays Mr. Chaptal *de le faire respirer à un asthmatique qui en effet a ete* PRODIGIEUSEMENT SOULAGE. (*Annales de Chemie* iv. 22.) It ſhould not be omitted that in one of Mr. Chaptal's phthiſical caſes, the firſt effect of oxygene air was ſuch that in three weeks the patient was able to take *pretty long walks*, though before ſo weak that he could not quit his bed. In this and another caſe it produced great animation and gaiety (*l. c.*).

T. B.

5th July, 1793.

N. B. The few typographical errors in the preceding pages are such as every reader will be able to correct.

Of the Bookſellers named in the title page may be had,

1. Spallanzani's DISSERTATIONS on DIGESTION, &c. 2 vols. tranſlated from the Italian, with additions, by Thomas Beddoes, M. D. Second Edition.

2. CHEMICAL EXPERIMENTS of a Philoſopher of the laſt Century, being an account of Mayow's Diſcovery of the Principal Properties of Elaſtic Fluids, by Thomas Beddoes, M. D.---Price 2s. 6d.

3. OBSERVATIONS on the Nature and Cure of Calculus, Conſumption, Sea Scurvy, Fever, &c. 8vo. by the same.

4. The HISTORY of ISAAC JENKINS and SARAH his Wife, and their Three Children.---Price 3d. by the same.

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